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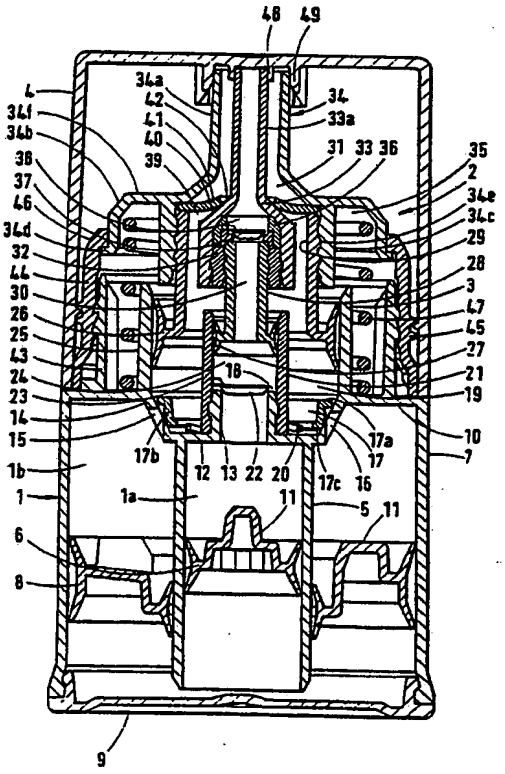
(54) Title: DISPENSING DEVICE FOR TWO FLUID MATERIALS

(57) Abstract

A dispenser for dispensing together a first fluid material and a second fluid material comprising a first material supply chamber (1a) and a second material supply chamber (1b) for containing first and second fluid materials, and a headpiece (2) comprising a first pump chamber (24) having a first pump piston (27) and being connectable to a first discharge channel (30) and to the first material supply chamber (1a) and a second pump chamber (19) having a second pump piston (26) and being connectable to a second discharge channel (31) and to the second material supply chamber (1b), and having a coaxial arrangement.



Dispensing device for two fluid materials

This invention relates to a novel device, being a dispenser for dispensing together two fluid materials, more particularly comprising material supply chambers for containing the two materials and a head piece comprising pump and discharge mechanisms for the two materials.

Dispensers of this type are known as portable supply containers in many fields of application and are used for dispensing liquid or paste-like products, e.g. for body care purposes, in the medical field for the application of medical compositions, or for the supply of paste-like alimentary products.

It is sometimes desired to disperse two viscous components simultaneously together, for example striped toothpaste formulations. A commonly adopted solution to this problem is a pump dispenser which contains both components in a single chamber, in direct physical contact with no intervening partition, relying upon the slowness of interdiffision to avoid mixing. Such a dispenser is clearly of no use when a chemical reaction can occur between the two components, in particular if such a reaction is actually intended to occur after the two components have been dispensed and subsequently mixed.

Attempts have been made to overcome the problems of premature mixing of reactive components in dispensers by dispensers which have two sets of containment chambers, pumps etc for the components, mounted side by side in a "double barrelled" arrangement. This system is inelegant and needs elaborate dispensing channels for the components unless they are to be dispensed in a side by side flow stream.

A further problem with components which are intended to react together after dispensing is that as the pumping pressure is released and the pump mechanism is allowed to return to a relaxed position small quantities of the dispensed components can be sucked back and mixed in the dispensing channels, where they can react. This can lead to contamination when components are subsequently dispensed, even clogging of the dispensing channels.

Particular problems of delivery are encountered when the two fluid materials comprise the first and second liquid phases (as defined therein) of a pharmaceutical composition of the type disclosed in EP-0152953 A for topical application. In such compositions the first phase contains a dissolved drug and is preferably saturated with the drug, whilst the second phase is a chemically or physically different liquid from that in the first phase and contains no drug, but is miscible with the first phase. The two phases are selected so that on mixing in a predetermined ratio the resultant drug concentration exceeds the saturated drug solubility in the resultant mixture. This produces a miscible liquid mixture supersaturated in the drug, which can increase the rate of drug penetration into the skin.

It will be appreciated that supersaturated solutions as formed in the compositions of EP-0152953A have a limited stability and that it is consequently desirable that they are formed on the point of application to the skin. Hence any premixing of the phases is undesirable.

A further problem with the compositions of EP-015953 is that they tend to be jelly-like materials, the viscosity of each component of which can vary independently as a result of manufacturing variations and ambient storage temperatures. In the case of pharmaceutical formulations prescribed or sold over the counter the temperature difference between home storage in a cold room or near a radiator or in sunlight can significantly alter the viscosity. Such viscosity changes can have a drastic effect on the flow of such components in a dispenser. Moreover if it is intended that the pumping action of a dispenser is to be hand action, there can be significant variation in the amount and rate of pressure application between consumers. It is therefore highly desirable to provide a dispenser which can dispense such formulations with an acceptably repeatable flow rate independent of component viscosity and pump pressure.

It is therefore an object of the present invention to provide a dispenser of the above-mentioned type which serves to dispense fluid materials, in particular liquid or paste-like materials, and permits a reliable, controlled dispensing of different phases of material such that the ratio of the two

In a further preferred embodiment of the invention a dispenser for dispensing together a first fluid material and a second fluid material, having a first material supply chamber and a second material supply chamber comprises:

a first pump chamber communicating with the first material supply chamber via a first non-return valve biassed to allow passage of first material only from the first material supply chamber to the first pump chamber;

a second pump chamber communicating with the second material supply chamber via a second non-return valve biassed to allow passage of second material only from the second material supply chamber into the second pump chamber;

the first pump chamber being coaxial with the second pump chamber;

the dispenser also having an outlet portion comprising a first discharge channel for the first material and a second discharge channel for the second material;

the first discharge channel comprising a discharge tube in a coaxial relationship within a surrounding tubular body, the second discharge channel being defined by the annular space between the discharge tube and the surrounding tubular body;

the first pump chamber communicating with the first discharge channel via a third non-return valve biassed to allow passage of first material only from the first pump chamber into the first discharge channel, and the second pump chamber communicating with the second discharge channel via a fourth non-return valve biassed to allow passage of second material only from the second pump chamber into the second discharge channel;

the first pump chamber and the second pump chamber having respectively first and second pump pistons slidably arranged therein;

the surrounding tubular body or an extension thereof being connected in an actuating relationship with at least the second pump piston and

The coaxial first and second pump chambers are also preferably in an concentric, double tube, relationship having an inner first pump chamber and a surrounding annular second pump chamber. As a consequence of such a coaxial arrangement of the first and second pump chambers, the corresponding first and second pistons are also in a coaxial, preferably concentric relationship. Preferably for compactness the first and second pistons are both hollow pistons.

The first piston preferably communicates with the first discharge channel via an opening, preferably a central opening, in the first piston. This opening may communicate with a first piston carrier tube which in turn communicates with the first discharge channel, the said opening, carrier tube and discharge channel preferably all being coaxial. The first piston carrier tube may fit into the inner end of the first discharge channel, either directly or via an adaptor. Conveniently the third non-return valve may be situated in the opening in the first piston, or in the first piston carrier tube, or in the first discharge channel, or at the junction of the carrier tube and the discharge channel, or in the adaptor if present. Conveniently the third non-return valve may be a flap valve, which may be biassed, opening in a downstream direction.

The second piston preferably communicates with the annular second discharge channel via a second piston carrier tube which surrounds at least part of the first discharge channel and/or the first piston carrier tube in a coaxial preferably concentric relationship, thereby defining an annular space around the first piston carrier tube, this annular space communicating with the annular second discharge channel, via the fourth non-return valve. This annular coaxial arrangment of the second piston carrier tube means that the fourth non-return valve is preferably in the form of an annular valve disc biassed to close one or more valve openings communicating between the said annular space and the annular second discharge channel.

The actuating relationship between the surrounding tubular body or an extension thereof and the second piston is preferably achieved by extending the tubular body into a cup-shaped actuation portion which at least partly encloses the second piston carrier tube. The walls of this

linked to the actuation portion that the action of the resilient bias can return both pistons into a non-axially displaced position when the actuating pressure is removed. Methods of arranging such a spring will be apparent to those skilled in the art, but a preferred arrangement is of a helical spring, coaxial, preferably concentric with and surrounding the second pump chamber, and mounted so as to bear against the end wall and the cup-shaped actuation portion.

During a return stroke in which the first and second pistons return into an uncompressed inoperative position, the first and second materials are thus pushed or sucked from the first and second material supply chambers into the first and second pump chamber, with the first and second non-return valves being opened, and are available in the first and second pump chambers for another dispensing operation.

An almost instantaneous dispensation of the first and second materials at a low delivery pressure and along small pump paths may be accomplished by the measures described above that a first non-return valve is arranged between the first material supply chamber and the first pump chamber which is connectable to the first material supply chamber, that a second non-return valve is arranged between the second material supply chamber and the second pump chamber which is connectable to the second material supply chamber, and that each of the discharge channels is controllable downstream of the first and second non-return valves by a third non-return valve and a fourth non-return valve respectively, and the valve bodies of the non-return valves are each controllable in response to a pressure difference upstream and downstream of the respective non-return valve. Moreover the provision of two separate sets of valves, i.e. first/second and third/fourth is found to substantially reduce or even eliminate suck-back of materials and to overcome the problems of variation in material viscosity and pumping pressure at least to some extent, making the rate of dispensing relatively independent of these variables.

A particularly useful feature of the dispenser of the invention is the ability to precisely control the ratio of the first and second materials dispersed over a wide range of total volume dispersed.

from 1:1 to 1:9 more suitably from 1:1 to 1:3.

The invention will now be described by way of example with reference to the accompanying drawings Figs 1 and 2 which show two forms of the device of the invention in a longitudinal sectional view.

Referring to Fig 1, the dispenser consists of a cylindrical container 1, generally, for separately receiving the first material in a first material supply chamber 1a and for receiving the second material in a second material supply chamber 1b that annularly surrounds the first material supply chamber 1a, and it further consists of a head piece 2, generally, which includes the delivery means 3, generally, for dispensing the first and second materials.

In the inoperative state the dispenser is closed by a closure cap 4 which can be put over head piece 2 onto container 1 in a snap-type seat.

The individual members of the dispenser are made of an injection-mouldable plastic, preferably polyethylene or polypropylene, so that on the one hand the dispenser is of a lightweight construction, and on the other hand the materials filled into container 2 are unaffected by the material of the dispenser.

Container 1 of the dispenser integrally includes a coaxial double-tube assembly with a central tube 5 for forming the first material supply chamber 1a and for receiving the first material and a first follower piston 6 therein. Said central tube 5 is radially spaced from and surrounded by an outer tube 7 which defines the outer container wall and serves to form the second material supply chamber 1b and to receive the second material as well as an annular second follower piston 8. Follower pistons 6, 8 which are coaxially arranged and slidable in the axial direction of the container are acted upon by atmospheric pressure, as bottom plate 9 of container 1 does not provide a pressure-tight seal for the chamber below follower pistons 6, 8. Central tube 5 and outer tube 7 (outer container wall) of container 1 are integrally connected to each other by an end wall 10 which simultaneously separates head piece 2 of the dispenser with delivery means 3 from product container 1 containing the first and second materials.

body 12 into the second pump chamber 19.

Tubular projection 13 of end wall 10 has provided thereon a first valve sleeve 21 with a valve flap 22 hinged thereto at one side as the valve body of a first non-return valve 23. Valve flap 22 cooperates with an outlet opening 18 of tubular projection 13 in such a way that in a closing position as is shown in figure 1, it sealingly closes outlet opening 18 of tubular projection 13. The first valve sleeve 21 is coaxially accommodated on tubular projection 13 via a snap-type connection, which is of advantage to an easy assembly, and extends through the second pump chamber 19 and annular valve body 17.

Valve flap 22 controls the flow communication between the first material supply chamber 1a with the first material upstream below valve flap 22 and a first pump chamber 24 downstream, i.e. above valve flap 22.

End wall 10 integrally comprises a first axial cylindrical projection 25 coaxially to and radially spaced externally from tubular projection 13 and the first valve sleeve 21, respectively. Cylindrical projection 23 defines the second pump chamber 19 in which valve opening 15 of the second non-return valve terminates, and a second pump piston 26 is slidably supported on the inner wall of said projection 25.

The second pump piston 26 is coaxial to a first pump piston 27 which is slidable in the first valve sleeve 21 and defines the first pump chamber 24.

Both the first and second pump pistons 27, 26 are formed as hollow pistons, and each of them integrally comprises first and second piston carrier tubes 28 and 29, respectively, forming a portion of a first discharge channel 30 and a second discharge channel 31, respectively, for the first and second materials.

The structure of the head piece with delivery means 3 shall now be explained in a general way with reference to the already described elements of the delivery means 3.

An upper actuation end of first piston carrier tube 28 of the first pump piston 27 is accommodated via an adapter sleeve 32 in an injector 33

interposed in a circumferential edge portion between annular carrier flange 39 and cup-shaped actuation portion 35 of tubular actuation body 34. Valve disk 41 has an annular configuration and rests with its inner circumference - for the control of valve openings 40 - on a transition portion between discharge tube 33a and tubular end portion 33b of injector 33, being biased by its own elasticity inherent to its material, and forms a fourth non-return valve 42 for controlling the second discharge channel 31. An axial movement of tubular actuation body 34 is thus transmitted via annular engagement flange 39 of injector 33 to the latter and to the first pump piston 27 supported by injector 33 so as to obtain a synchronous movement with the second pump piston 26.

A cylindrical body 43 is integrally or separately connected to end wall 10 of container 1 radially externally with respect to the axial cylindrical projection 25 of end wall 10. Cylindrical body 43 serves to lockingly receive an outer snap-type sleeve 44 which, in turn, circumferentially includes snap-type projections 45 for a snap-type seat of closure cap 4 as well as an engagement projection 46 at its upper end for locking engagement with the circumferential snap-type projection 34b of tubular actuation body 34. Tubular actuation body 34 is thereby reliably retained, and foreign matter is simultaneously prevented by snap-type sleeve 44 from penetrating into head piece 2. In a space provided between cylindrical body 43 and inner cylindrical projection 25, a helical compression spring 47 extends in axially biased fashion between end wall 10 and transverse ribs 35 of tubular actuation body 34. After a dispensing operation helical compression spring 47 ensures the return of tubular actuation body 34 together with the associated pump pistons 27, 26 into the inoperative position shown in figure 1.

In its inner bottom portion closure cap 4 centrally comprises coaxial ring projections 48, 49 for sealingly engaging the respectively upper end of annular actuation body 34 and injector 33 and for closing the first and second discharge channels 30 and 31. This prevents the drying out of any first and second materials remaining in the tubular end portion 34a of tubular actuation body 34 or in the end portion 33b of injector 33.

All of the above-described individual members of the dispenser, possibly with the exception of helical spring 47 which may be made of metal,

pump piston 19 and the end portion 33b of injector 33 and is dispensed through the annular end portion 34a of the tubular actuation body and injector 33 at the opening of the second discharge channel under release of the valve openings 40 by the elastic valve disk 41, which is elastically deformed in its open position. During the sliding operation the tubular actuation body 34 is slidingly guided by both snap-type sleeve 44 and pump pistons 26, 27 together with the associated slide surfaces of the axial cylindrical projection 25 and the first valve sleeve 21, respectively. The available stroke is here determined by the distance between a lower edge of the circumferential snap-type projection 34d and the upper end of cylindrical body 43.

The tubular actuation body 34 may be depressed by hand pressure, for example by holding the container 1 in the hand and pressing the open end of the tubular end portion 34a against a surface. Alternatively the container 1 may be gripped by the hand, and finger or thumb pressure applied to the upper surface 34f of the end portion. The surface 34f may be provided with finger pads to assist this.

When the tubular actuation body 34 is subsequently no longer depressed, it slides together with injector 33 and the first and second pump pistons 27, 26 under the action of helical spring 47 upwards back into its initial position as is shown in figure 1. Pump chambers 24 and 19 become now larger again. The resultant vacuum has the effect that the annular valve body 17 is removed from its valve seat on connection portion 14 and moves upwards against the resilient force of valve spring 20, so that valve openings 15 are released and the second material is fed into the second pump chamber 19 with annular follower piston 8 moving upwards. The same is applicable with regard to the opening of valve flap 22 which pivots upwards and permits the supply of the first material with the aid of follower piston 6 into the first pump chamber 24. The third and fourth non-return valves 38, 42 are here closed or perform their closing operation at the beginning of the return movement due to the decreased pressure in the first and second pumps chambers 24, 19. This closing movement of the second valve flap 37 and of valve disk 41 is supported by a certain back suction of the material plug positioned above vlave disk 41 and valve flap 37 and formed by the first and second materials.

(bottom) and the right half of Fig.2 shows the first follower piston 6 and the second follower piston 8 in their upper end positions against respectively projection 13 and end wall 10. The ring or stop projections 11 are up against the correspondingly shaped upper portions of projection 13 and end wall 10, so as to leave the minimum practicable void space in the upper end of chambers 1a and 1b respectively.

The delivery means 3 of the device of Fig.2 differs from that of Fig.1 in that the delivery means is constructed so that the materials contained in chambers 1a and 1b are delivered in a direction at an angle to the overall axis of the container 1, head piece 2 and closure cap 4.

In the embodiment of Fig.2 this angled delivery is achieved by the provision of a delivery head 50, generally, which incorporates coaxial inner dispensing channel 51 and outer dispensing channel 52. The inner and outer dispensing channels, 51, 52 cooperate respectively in a fluid-tight engagement with a shortened discharge tube 33a and tubular end portion 34a.

The inner and outer dispensing channels 51, 52 bend through an angle relative to the longitudinal axis of the container 1 and head piece 2 to define a delivery direction at an angle to the axis of the discharge tube 33a and portion 34a whilst remaining coaxial. The dispensing channels 51, 52 terminate at respective open ends, which are closed by a removeable closure 53 provided with a handle 54 for easy opening.

The dispensing channels 51, 52 are formed integrally with a bell-shaped cover 55, which is shaped so as to fix over a projecting part 34g of the actuation body. The cover 55 is provided with inwardly projecting elements 55a which engage with the lower edge of the projecting part 34g. The cover 55 is also provided with outer circumferential snap-type projection 34d to enable it to be retained within the outer snap-type sleeve 44.

The bell-shaped cover and the delivery tubes 51, 52 are enclosed by the closure cap 4.

The device of Fig.2 operates in a manner analogous to that of Fig.1. The

CLAIMS

1. A dispenser for dispensing together a first fluid material and a second fluid material, comprising a first material supply chamber and a second material supply chamber for respectively containing said first and second fluid materials, and a head piece which comprises a first pump chamber having a first pump piston and being connectable to a first discharge channel and to the first material supply chamber, and a second pump chamber having a second pump piston and being connectable to a second discharge channel and to the second material supply chamber, characterised by a coaxial arrangement of at least the first and second discharge channels, optionally also the first and second pump chambers and optionally also the first and second material supply chambers being in a coaxial arrangement

2. A dispenser according to claim 1 wherein the first and second pump chambers are in a coaxial arrangement.

3. A dispenser according to claim 1 or 2 wherein the first and second material supply chambers are in a coaxial arrangement.

4. A dispenser according to claim 1, 2 or 3 wherein an end portion of said first discharge channel is formed by an injector, and a second discharge channel which is entirely separate from said first discharge channel inside the head piece of the dispenser and used for discharging the second material is defined by a tubular body which surrounds said channel and simultaneously constitutes a pump actuating member of the dispenser.

5. A dispenser according to any one of the preceding claims which comprises:
a first pump chamber communicating with the first material supply chamber via a first non-return valve biassed to allow passage of first material only from the first material supply chamber to the first pump chamber,
a second pump chamber communicating with the second material supply chamber via a second non-return valve biassed to allow passage of second material only from the second material supply chamber into the second

the volume ratios of the first material supply chamber : second material supply chamber and/or first pump chamber : second pump chamber is in the range 1 : 1 to 1 : 9.

8. A dispenser according to claim 7 wherein the said ratios are in the range 1 : 1 to 1 : 3.

9. A dispenser according to any one of the preceding claims wherein the first and second pumps are operable by hand action.

10. A dispenser according to any one of the preceding claims, substantially as hereinbefore described, with reference to the accompanying drawing.

11. A dispenser according to any one of the preceding claims and containing first and second fluid materials, wherein one of the first or second fluid materials
comprises a first liquid phase containing a drug dissolved therein, and the other comprises a second liquid phase which is physicaly and/or chemically different from the first liquid phase but miscible therewith and optionally containing the same drug dissolved therein, the concentration of the drug in each phase and the composition of the phases bein such that on admixture of the phases, the resultant total drug concentration is greater than the saturated drug solubility in the initially formed resultant mixture, thereby producing a mixture supersaturated with the drug.

12. A dispenser according to claim 11 wherein the first liquid phase comprises the first fluid material, and the second liquid phase comprises the second fluid material.

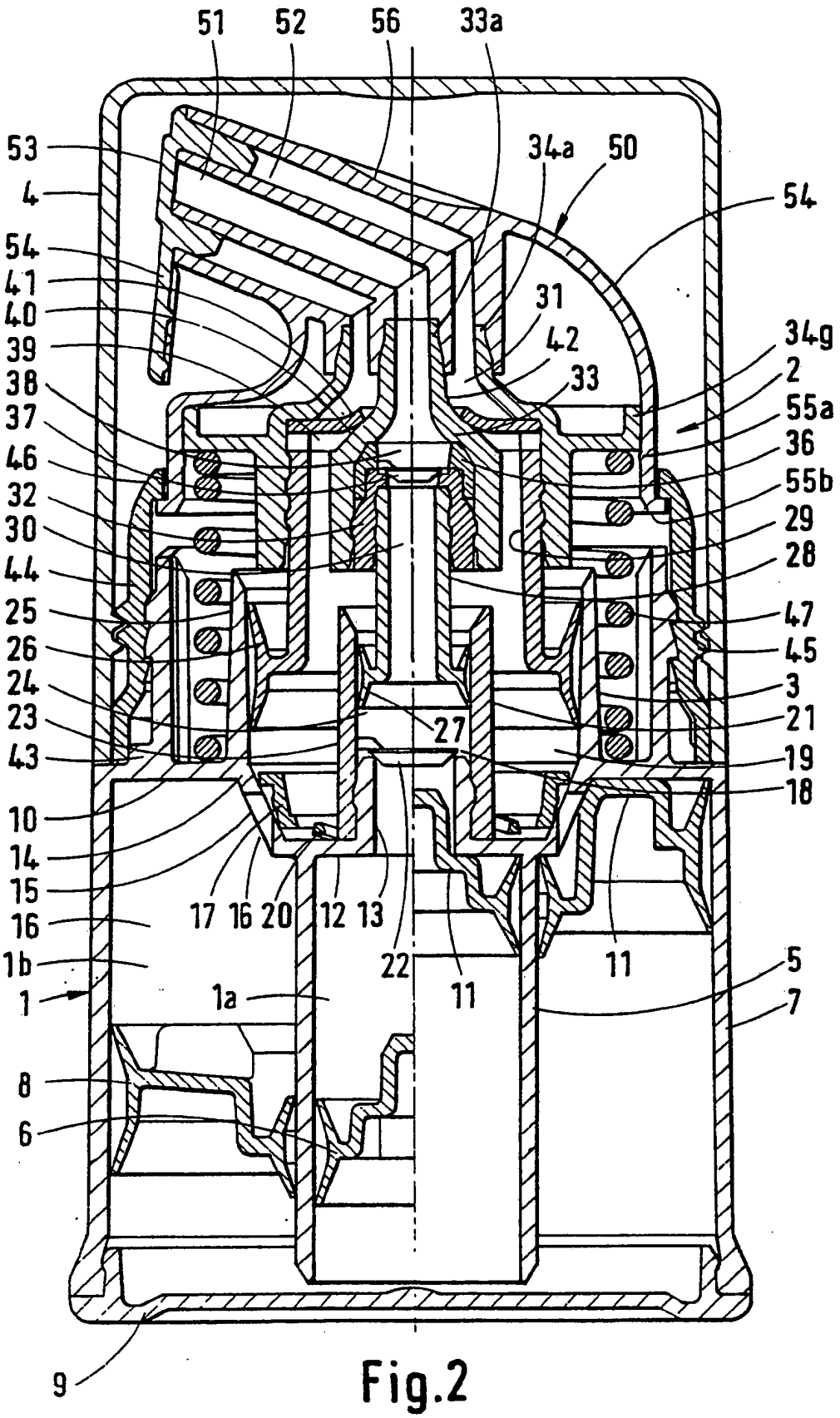


Fig.2

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9201542 SA 63639

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